THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

082 **ELECTRICAL ENGINEERING SCIENCE**
(For both School and Private Candidates)

Time: 3 Hours **Friday, 8th October 2010 p.m.**

Instructions

1. This paper consists of sections A, B and C.
2. Answer **all** questions in sections A and B and **three (3)** questions from section C.
3. Calculators are **not** allowed in the examination room.
4. Cellular phones are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).
6. Whenever necessary use the following constants
   Permitivity of free space, $\varepsilon_o = 8.854 \times 10^{-12}$ F/m.
   Resistivity of copper may be taken as 1.7 μΩ.mm
   Specific heat capacity of water = 4.18 kJ/kg^{0}C
   1 Faraday = 96,500 Coulombs.
   1 hp = 746 Watts.

This paper consists of 6 printed pages.

uk print

Scanned by CamScanner

SECTION A (10 Marks)

Answer **all** questions in this section.

1. For each of items (i) – (x) choose the correct answer from among the given alternatives and write its letter beside the item number.

(i) For the circuit shown in Figure 1, what will be the current, I flowing through the circuit?

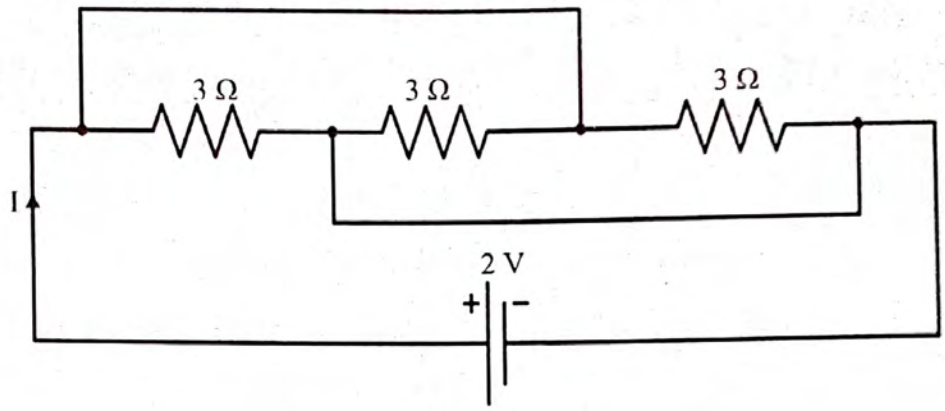


Figure 1

A $\frac{1}{2}$ A
B 1A
C 2A
D 4A
E $\frac{1}{4}$ A.

(ii) Which one of the following is not a good material property for an electric contact?

A High melting point
B Good thermal conductivity
C High resistance to erosion
D High elasticity
E High resistivity.

(iii) For a shunt generator, which loss is considered as constant?

A Copper loss
B Eddy current
C Hysterisis loss
D Friction loss
E Mechanical loss.

uk print

Scanned by CamScanner

(iv) Which of the following expressions is correct for the series reactance X_{CS}, if three capacitors C1, C2 and C3 are connected in series?

A $\frac{1}{X_{CS}} = \frac{1}{X_{C1}} + \frac{1}{X_{C2}} + \frac{1}{X_{C3}}$

B $X_{CS} = X_{C1} + X_{C2} + X_{C3}$

C $X_{CS} = \frac{1}{X_{C1}} + \frac{1}{X_{C2}} + \frac{1}{X_{C3}}$

D $X_{CS} = \frac{1}{X_{C1} + X_{C2} + X_{C3}}$

E $\frac{1}{X_{CS}} = \frac{1}{\frac{1}{X_{C1}} + \frac{1}{X_{C2}} + \frac{1}{X_{C3}}}$.

(v) What will be the efficiency when the transformer operates at unity power factor and 60 % of full load?

A 91.8 %
B 93.3 %
C 96.5 %
D 99 %
E 99.4 %.

(vi) Which of the following is a factor whereby the level of illumination on a surface does not depend on?

A Candle power of the source
B Distance from the source
C Type of reflector used
D Increase glass shell diameter
E Increase the supply voltage.

(vii) A bridge used for measurement of capacitance is

A wheatstone bridge
B wein bridge
C max well bridge
D schearing bridge
E anderson bridge.

(viii) Polarization in simple cells refers to

A giving polarities to cells
B supplying large amount of energy
C insulating the anode
D destroying the cell
E insulating the cathode.

Scanned by CamScanner

(ix) A generator can be described as a machine which converts
A heat energy into electrical energy
B an electrical energy into mechanical energy
C solar energy into electrical energy
D mechanical energy into electrical energy
E chemical energy into electrical energy.

(x) The common effect of an electric current in a day to day domestic use is
A luminous
B chemical
C heat
D magnetic
E temperature.

SECTION B (30 Marks)

Answer **all** questions in this section.

2. (a) State Coulomb's law.

(b) Two point charges 10 μC and 20 μC are placed at a distance of 30 cm apart in a medium of $\varepsilon_r = 6$. Find the force between them.

(c) If the charges in 2 (b) above are placed in air, what will be the force between them?

3. State Faraday's laws of electromagnetic induction.

4. (a) Define the term *'resistance'* as used in electric circuit.

(b) A d.c arc has a voltage current relation given by $V = 20 + \frac{40}{I}$, is connected in series with a resistor, R. The total voltage applied is 120 V. If the voltage across the arc is half the voltage across the resistor, find the value of the resistor.

5. Find an expression for the current when a voltage $E = 283\,Sin100\pi t$ is applied to a coil having R = 50 Ω and L = 0.159 H.

6. Explain four (4) indicators which show that a cell is fully charged.

Scanned by CamScanner

7. (a) Give three (3) differences between lap winding and wave winding as used in d.c generator.

(b) The induced e.m.f in a d.c generator running at 2500 r.p.m is 500 V. Calculate the induced e.m.f, when it runs at 1000 r.p.m.

8. A 230 V, 2 hp d.c motor drives a pump. The input power to the motor is 1700 W. Determine the current taken by the motor and efficiency of the motor.

9. A moving coil instrument gives full-scale deflection with 25 mA. The resistance of the coil is 5 Ω. It is required to convert this meter into an ammeter to read up to 5 A. Find the:

(a) Resistance of the shunt to be connected in parallel with the meter.

(b) Value of the series resistance for the above meter to read up to a voltage of 20 V.

10. Mention three (3) properties of a good illumination.

11. Give two (2) factors which determine the heat gained by a body when there is a temperature change.

SECTION C (60 Marks)

Answer **three (3)** questions from this section.

12. (a) Define the term *'capacitance'* of a capacitor.

(b) Two capacitors A and B are connected in series across a 200 V d.c supply. The p.d across A is 120 V. When a capacitor of 3 μF is connected in parallel with B the p.d across A is increased to 140 V. Calculate the capacitance of A and B.

13. (a) Define the following terms.

(i) Rectifier

(ii) Filter

(b) A half wave rectifier is connected in series with load resistor of 14 Ω to an a.c supply of 20 volts r.m.s value. The rectifier may be taken as having a constant resistance of 1.5 Ω in the forward direction while the reverse current being zero. Calculate the average and peak values of the currents in the load.

Scanned by CamScanner

14. The total current taken by a number of identical single-phase motors is 200 A with a power factor of 0.5, when their capacitors are out of circuit. Calculate the:

(a) Total current when the power factor is brought to unity by switching in the capacitors.

(b) Total current and power factor when 50 % of the motors are switched off with the capacitors still in circuit.

In each condition illustrate your answer by means of a phasor diagram.

15. (a) Define '*power factor*' of a circuit.

(b) A delta connected load consists of a resistance of 10 Ω and a capacitance of 100 μF in each phase. A supply of 410 V at 50 Hz is applied to the load. Find the line current, power factor and power consumed by the load.

16. (a) What are the three (3) means of heat transfer?

(b) State three (3) types of electric heaters.

(c) An immersion heater rated at 4 kilowatts is used to heat a tank containing 200 litres of water. If the overall efficiency is 80%, determine the time taken to increase the temperature of the water from 12°C to 90°C. One litre of water has a mass of one kilogram.

uk print

Scanned by CamScanner